



## Age and speleogenesis of epigenic gypsum caves in the northern Apennines (Italy)

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Triassic and Messinian gypsum beds host the majority of the caves in the eastern flank of the northern Apennines. To date, more than six hundreds voids have been mapped, including the longest known epigenic gypsum cave system in the world (Spipola-Acquafredda, ~11 km of tunnels) (De Waele et al., 2013). Superimposed caves are typically sub-horizontal (Klimchouk, 2000) and connected through vertical shafts, reflecting the palaeo base-level variations. When preserved, river terraces at the surface lie at the same palaeo altitude of the base level and horizontal cave passages.

Notwithstanding the well-known geology of the area known (Vai and Martini, 2001), the age of these caves has been greatly underestimated in the past. Considering the rapid dissolution of the gypsum and uplifting of the area, the start of speleogenesis activity was considered to have occurred during the last glacial age.

The age of karst voids can be only indirectly estimated by the dating of the infilling sediments. U-Th dating on carbonate speleothems provides high-precision and accurate ages (Hellstrom, 2003; Scholz and Hoffmann, 2008). We thus applied this methodology to 20 speleothems coming from 14 different caves belonging to the Monte Tondo, Spipola Acquafredda, Castelnuovo, Stella-Rio Basino and Brisighella systems. The results show that: i) caves were forming since at least ~300 ka; ii) the peak of speleogenesis was reached during relatively cold climate stages, when rivers formed terraces at the surface and aggradation caused paragogenesis in the stable cave levels (Columbu et al., 2015).

Besides the significant contribution to the understanding of the Apennines evaporite karst evolution, this study (and its further advancement) may also refine knowledge of the local vs regional uplifting rates and base-level variations since the late Pleistocene (Wegmann and Pazzaglia, 2009).

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